Non-Discretionary Project Results For FY 1998

Project 98-001-00: Analytical Support - PATH and ESA Biological Assessments - Hinrichsen Environmental Services

BPA Contact: Jim Geiselman

FY99 Forecast: $119,900

FY98 Funding: $99,580

Project Requirements:
This contract provides ongoing independent scientific support from Dr. Richard Hinrichsen for BPA's participation in PATH and ESA assessments of the expected effectiveness of management actions in the face of high levels of uncertainty. Specific expertise in the area of mathematics and statistics is applied to the understanding of those uncertainties. As part of the modeling efforts underway through PATH, the contract provides participation in PATH working groups to help develop model structures that allow a larger array of hypotheses to be included in the evaluations. The contract provides techniques needed to test the assumptions of the models used in decision support and provide further quantification of the uncertainties in the decision analysis. The project also provides support for adaptive management design questions such as required sample sizes and the size of responses needed to meet statistical tests. Direct participation is provided in PATH working groups and through review of PATH products.

Project History:
The project (number 9800100) began FY98 on October 19, 1997. The objectives for the project were outlined in a work plan.

The work plan identified six different general tasks:
(1) Spring/Summer chinook analysis
~~(3)~~(2) Fall Chinook Analysis
~~(4)~~(3) Steelhead Analysis (not yet implemented)
~~(5)~~(4) Spring/Summer PIT tag analysis (ongoing with Paulsen)
~~(6)~~(5) Prospective Modeling
~~(7)~~(6) Additional Tasks

Results Achieved in FY 1998:

Task 1. Spring/Summer chinook analysis.
Developed alternative model structures (the alpha model) for use in retrospective and prospective modeling.

Developed and documented alternative hypotheses for inclusion in decision support analysis. The included alternate formulations of yearly effects of climate and the effect of a regime shift on spring chinook productivities.
Co-authored PATH preliminary decision analysis report (PATH 1998). Described in detail the alpha life-cycle model and the regime shift hypothesis. Provided the rationale for the regime shift hypothesis and presented supporting data and literature review.
Tested various extra mortality hypotheses: climate regime shift, BKD, and hydro-related extra mortality hypotheses using retrospective modeling results. Documented results (Hinrichsen and Paulsen 1998a)
Conducted sensitivity analyses on the retrospective delta model. Discovered a small subset of data (John Day Middle Fork data) that drive the high in-river mortality estimate, high per-dam mortality estimate, and the high estimate of intrinsic productivity of the Snake stocks. ~~I r~~Researched the quality of the John Day Middle Fork data and discovered observations that are highly questionable. ~~I was the first to conduct~~These were the first such analyses of influential data (Hinrichsen 1998).
Compiled and ran the Fortran version of the retrospective delta model and compared it to output from a statistical program (S-PLUS). S-PLUS confirmed the maximum likelihood estimates attained using the Fortran version.

Task 2. Fall Chinook analysis.
Detected an error in implementation of the retrospective fall chinook analysis and offered a solution. The error resulted from a misinterpretation of passage survival input and was corrected.
Developed an alternative model structure for treating the potential effects of a climate regime shift on the Snake River fall chinook stocks.
Demonstrated a need to estimate the ratio post-Bonneville survivals of in-river and transported fish outside of the spawner-recruit model. Tested various retrospective models based on various fit criteria (AIC and BIC). Submitted results to PATH via e-mail.
Compiled the version of the retrospective Fall Chinook model presented in FORTRAN by Rick Deriso. Tested the output against results from a statistical package (S-PLUS) and my own version of the FORTRAN code. This led to the detection of an error described above.

Task 4. Spring/Summer Pit-tag analysis
Reviewed and discussed in detail with C. Paulsen the methods for analyzing over-wintering survival of spring/summer chinook in various subbasins Paulsen produced a report " Snake River Chinook Parr-Smolt Survival and Habitat Quality Indices."
Task 5. Prospective Analyses
Developed pseudo code and variable dictionary for segments of the Fortran Bayesian Simulation Model, which projects spring/summer chinook recruitment.
Conducted sensitivity analysis of the probabilities for spring/summer chinook actions to meet the jeopardy standards.
Described the difficulties of working with an unbalanced design to determine critical uncertainties (hypotheses) in the PATH decision support analysis. Worked closely with

ESSA and Charlie Paulsen to resolve the difficulties posed (Hinrichsen and Paulsen 1998b).
Discovered a bias in the way the hydro-related extra mortality hypothesis was framed mathematically. It described a positive relationship between passage survival and post-Bonneville survival of in-river fish, when none really existed in the retrospective data (Hinrichsen and Paulsen, 1998a).

Reports for FY 1998

PATH. 1998. Preliminary Decision Analysis Report on Spring/Summer Chinook.

Hinrichsen, R. A. 1998. Influence of Exceptional Spawner-Recruit data of the John Day Middle Fork on the Delta Model Parameters. PATH memo. See **Error! Bookmark not defined.**

Hinrichsen, R. A. and C. Paulsen. 1998a. Testing the Hydro-Related Extra Mortality Hypothesis. Technical report submitted to PATH. Incorporated into PATH Weight of Evidence Report Appendix (submission 3). June 10, 1988.

Hinrichsen, R.A. and C. Paulsen. 1998b. Weighting and sensitivity analysis difficulties with an unbalanced design. PATH memo submitted April 29, 1998.

Paulsen, C. and R. A. Hinrichsen. 1998. Hatchery Hypothesis: Variation in releases of Snake River hatchery spring/summer chinook is associated with variation in extra mortality of naturally produced Snake River spring/summer chinook. PATH memo. June 12, 1998.